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Thomas W Gorman
E I Du Pont De Nemours and Company
Legal Patent Records Center
4417 Lancaster Pike
Wilmington, DE 19805

EXAMINER	
ENIN-OKUT, EDU E	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/550,424	ANDRIN ET AL.	
	Examiner	Art Unit	
	Edu E. Enin-Okut	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 27-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 27-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 September 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/27/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

PROCESS FOR SEALING PLATES IN AN ELECTROCHEMICAL CELL

DETAILED ACTION

Election/Restrictions

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

> **Group I, claims 1-4 and 27-46**, drawn to a process for sealing a first coolant plate of an electrochemical cell with an adjacent plate.
>
> **Group II, claims 47-52**, drawn to an electrochemical cell component and an electrochemical cell.

2. The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature, namely the process described in claim 1, while shared between all groups, does not offer contribution over the prior art:

Mercuri (US 2003/0000640) discloses a process for sealing a first coolant plate of an electrochemical cell with an adjacent plate (para. 7, 77; 'for a cooling medium'), wherein the first coolant plate comprises at least one mating region for mating with a complementary region on the adjacent plate, wherein the adjacent plate is a second coolant plate or a bipolar plate of the electrochemical cell (Fig. 4), and the first coolant plate and the adjacent plate each comprise a polymer and conductive filler (para. 78, 79), said process comprises the step of welding said mating region to said complementary region to create a seal formed by the polymer at the mating region and the complementary region (para. 78, 79).

3. During a telephone conversation with Thomas W. Gorman on April 30, 2009, a provisional election was made with traverse to prosecute the invention of **Group I, claims 1-4 and 27-46**. Affirmation of this election must be made by applicant in replying to this Office action. Claims 47-52 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 38 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 38 recites a "… maleic anhydride modified polymer with the thermoplastic polymer, partially fluorinated polymers and liquid crystalline polymer or mixtures thereof." However, claim 37 recites "… a thermoplastic polymer selected from the group consisting of melt processible polymers, partially fluorinated polymers, thermoplastic elastomers, liquid crystalline polymers, polyolefins, polyamides, aromatic condensation polymers, and mixtures thereof." It appears that Applicant is using a thermoplastic polymer as a group in claim 37 but then is using the term "thermoplastic polymer" as a species in claim 38.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 2, 39, 40, 44, 45 and 46 are rejected under 35 U.S.C. 102(b) as being anticipated by Turpin et al. (WO 02/091506 A1).

Regarding claims 1, 2, 39 and 40, Turpin teaches a flow field plate, with fluid manifolds (flow fields) for fuel cell reactant gases and coolants, having a plurality of protrusions (sealing ridges 7,8,9) that engage with complementary protrusions on an adjacent flow field plate to join and seal it to the adjacent plate via ultrasonic welding (p. 4, 5, 7, 8; Figs. 2, 3). The plates are composed of a polymer with conductive filler (e.g., a thermoplastic with graphite) and carbon nanotubes (p. 5, 6).

Regarding claims 44, 45 and 46, it has been held that, to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 135 USPQ 31 (BPAI 1961). However, Turpin does teach that the protrusions described above are formed near the periphery of the plates as shown in Figs. 2 and 3; and, that the a number of flow fields are formed on the plate (p. 8; Figs. 2, 3).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 3, 4 and 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turpin et al. as applied to claims 1, 2, 39, 40, 44, 45 and 46 above, and further in view of Burke (US 4,673,450) and Marianowski (US 6,261,710).

Turpin is applied and incorporated herein for the reasons above.

Regarding claim 3, Turpin does not expressly teach that the welding step is *resistance* welding (emphasis added).

Burke teaches a method of welding together graphite fiber reinforced thermoplastic laminates that includes placing the two separate pieces to be welded together adjacent each other and applying pressure to the outer sides of the parts (Abstract; 1:50-54). A pair of electrodes is placed on the opposite outer sides of the parts to be welded (1:54-55). A spot weld or weld seam, with good lamination in the weld area, can be accomplished applying voltage in the range of 20 to 40 volts and amperage in the range of 30 to 40 amps using the electrodes for approximately 5 to 10 seconds (1:44-48, 1:55-57, 2:37-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use resistance welding to join the flow field plates of Turpin because Marianowski teaches that resistant welding can produce a bond that lowers the contact resistance between joined components, and in turn, promotes better electrical conductivity (see Marianowski, 5:21-23, 6:19-24).

Regarding claims 4 and 31, Turpin teaches (a) placing the mating region and complementary region in close proximity to each other (flow field plate protrusions that engage with complementary protrusions on an adjacent plate to join and seal it to that plate) (p. 4, 5).

However, Turpin does not expressly teach: (b) applying an electrical current between the first coolant plate and the adjacent plate to produce localized heat at the mating region and complementary region sufficient to melt the polymer at the mating region and complementary region; or, (c) ceasing to apply the current and applying pressure to the first coolant plate and the adjacent plate to allow the melted polymer to cool and to create a seal at the mating region and complementary region; or, that the electrical current is applied using external electrodes or the plates themselves.

However, Burke, discussed above, also teaches applying voltage and amperage across electrodes sufficient to soften a thermoplastic material in surface contact between the electrodes; and, cooling those parts in the surface contact area to form a weld (claim 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to weld the plates used in the process of Turpin, as modified by Burke, using a resistance welding step to apply the electrical current between the plates with external electrodes that melt the polymer at mating and complementary regions, and to stop the current to allow the melted surfaces to cool and form a seam, because Burke teaches a weld with good lamination in the weld area can be produced.

Regarding claims 27, 28, 29 and 30, Burke teaches applying voltage in the range of 20 to 40 volts and amperage in the range of 30 to 40 amps using electrodes for approximately 5 to 10 seconds when using resistance welding to form a seam between thermoplastic components, as discussed above. Burke also teaches applying pressure to the outer sides of the components in the range of 50 to 100 psi during the welding process (Abstract; 1:50-54, 2:24-28).

It has been held that obviousness exists where the claimed ranges overlap or lie inside ranges disclosed by the prior art. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*,

919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05 (I). Further, the courts have also held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. *In re Aller*, 105 USPQ 233. See MPEP 2144.05 (11).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to apply sufficient current, voltage and pressure during the resistance welding step used in the process of Turpin, as modified by Burke, to adequately join the plates together by creating good lamination in the weld area without damaging those components.

12. Claims 32-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turpin et al. as applied to claims 1-4, 27-31, 39, 40, 44, 45 and 46, and further in view of Ledjeff et al. (US 5,733,678) and Scherer (US 3,860,468).

Turpin is applied and incorporated herein for the reasons above.

Regarding claim 32, Turpin does not expressly teach that the welding step is *vibration* welding (emphasis added)

Ledjeff teaches that the thermoplastic polymer individual components of a fuel cell, such as its current collector and current distributor, are held together by a bonding process, without seals like welding or gluing, employing frictional or high frequency welding (Abstract; 8:39-48, 8:49-9:6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use vibration welding to join the plates used in the process of Turpin because Ledjeff teaches that vibration welding requires very little to no additional sealing material (see Ledjeff, 5:56-60).

Regarding claims 33 and 34, Turpin teaches (a) placing the mating region and complementary region in close proximity to each other (flow field plate protrusions that engage with complementary protrusions on an adjacent plate to join and seal it to that plate) (p. 4, 5).

Turpin and Ledjeff do not expressly teach: (b) applying a vibrational force between the first coolant plate and the adjacent plate to produce localized heat at the mating region and complementary region sufficient to melt the polymer at the mating region and complementary region; or, (c) ceasing to apply the vibrational force and applying pressure to the first coolant plate and the adjacent plate to allow the melted polymer to cool and to create a seal at the mating region and complementary region; or, that the vibrational force is applied at a frequency of between about 100 and about 500 cycles per second for a time from about 3 to about 100 seconds at an amplitude of between abut 0.5 and about 5 mm.

Scherer teaches a method of friction welding two thermoplastic parts together in predetermined alignment with each other including cyclically moving the parts relative to one another which sets up a relative vibration between the two parts; where opposing forces are substantially equal while pressing the two parts into surface contact with each other for a time sufficient to melt the contacting surfaces by frictionally induced heat; stopping the relative vibration with the parts in predetermined alignment; and, holding the parts in predetermined alignment with the surfaces pressed into contact with each other until the melted thermoplastic resin hardens (Abstract). The friction welding method also includes oscillating the two parts relative to one another through a displacement of small amplitude so that the vibration frequency is about 100 cycles/second and produces a relative movement between the contacting surfaces of between 2 and 8 millimeters during each half cycle of vibration (claim 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply vibrational force and pressure during the vibration welding step used in the process of Turpin, as modified by Ledjeff, in the manner taught by Scherer, and allow the melted surfaces to cool and form a seam, to form a welded component requiring very little to no sealing material, as discussed above.

As to applying the vibrational force for a time from 3 to about 100 seconds, it would have been obvious to one of ordinary skill in the art to apply the vibration welding step used in the process of Turpin, as modified by Ledjeff and Scherer, for a time sufficient to melt the contacting surfaces of the

plates by frictionally induced heat to facilitate the subsequent bonding of those surfaces (see Scherer, Abstract).

Regarding claims 35 and 36, Scherer teaches clamping the parts together to create a pressure at the surfaces to be welded of 15 to 35 kg/cm^2 (i.e., 198 to 412 psig) (Abstract; 3:30-37).

It has been held that obviousness exists where the claimed ranges overlap or lie inside ranges disclosed by the prior art. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05 (I). Further, the courts have also held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. *In re Aller*, 105 USPQ 233. See MPEP 2144.05 (11).

Thus, one of ordinary skill in the art at the time of the invention would have found it obvious to apply a force to diffusion layer and separator plate of Davis during the welding process, as taught by Scherer, to urge the mating surfaces of the parts together and promote the melting of the mating surfaces due to the friction set up between the parts (see Scherer, 3:44-47).

13. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Turpin et al. as applied to claims 1-4, 27-36, 39, 40, 44, 45 and 46, and further in view of Yamada et al. (JP 2000-017179 A; refer to JPO Abstract and machine translation).

Turpin is applied and incorporated herein for the reasons above.

Regarding claim 37, Turpin does not expressly teach that the thermoplastic polymer discussed above is selected from the group recited in the claim.

Yamada teaches a conductive resin composition, usable as separator for fuel cell, composed of a (A) liquid crystal polymer, (B) conductive filler (e.g., graphite), and if necessary, (C) carbon fiber or glass fiber, capable of exhibiting excellent moldability, conductivity, gas seal performance and strength

(Abstract; machine translation, para. 16, 17, 19). This composition includes preferably 50 to 900 pts. wt, more preferably 100 to 600 pts. wt., of component (B) per 100 pts. wt. of component (A) (Abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a liquid crystalline polymer when forming the plates of Turpin because Yamada teaches that this polymer facilitates the formation of a fuel cell component exhibiting excellent conductivity and strength.

14. Claims 41, 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turpin et al. as applied to claims 1-4, 27-37, 39, 40, 44, 45 and 46, and further in view of Davis (GB 2 326 017 A).

Turpin is applied and incorporated herein for the reasons above.

Regarding claims 41, 42 and 43, Turpin does not expressly teach that the first coolant plate and the adjacent plate includes a polymer rich outer layer on either the mating region, the complementary region, or both; or, that the polymer rich outer layer is between about 25 wt % and about 100 wt % polymer, or about 50 wt % and about 100 wt % polymer.

Davis teaches a fuel cell assembly including thermoplastic bipolar plates, with an electrically conductive filler (e.g., carbon powder or fiber), forming adhesive bonds with other cell components without additional gaskets or seals (Abstract; p. 3, lines 28-30; p. 4, line 31-p. 5, line 3). A thin layer of thermoplastic material with a low melt index may be applied to specific locations on the plate and serve to fuse the plate to an adjacent component under heat and pressure (p. 6, lines 4-20). Further, the layer of thermoplastic material may be rendered conductive by filling it with conductive material (p. 6, lines 25-27). One would appreciate that the thin layer of thermoplastic material can be up to 100 wt % polymer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polymer rich outer layer on at least one of the plates used in the process of Turpin because Davis teaches that it may serve as means with which to join the plates together.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Edu E. Enin-Okut** whose telephone number is **571-270-3075**. The examiner can normally be reached on Monday-Thursday, 7 a.m. to 3 p.m. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http:llpair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edu E. Enin-Okut/
Examiner, Art Unit 1795

/PATRICK RYAN/
Supervisory Patent Examiner, Art Unit 1795